BABA GHULAM SHAH BADSHAH UNIVERSITY

RAJOURI

(SYNOPSIS FOR REGISTRATION FOR DEGREE OF DOCTOR OF PHILOSOPHY IN BOTANY)

Proposed Topic	: Studies on lichens of Rajouri district with emphasis on air pollution monitoring
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SYNOPSIS FOR REGISTRATION FOR DEGREE OF DOCTOR OF PHILOSOPHY IN BOTANY

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Background and justification:

Rajouri, the border district of Jammu and Kashmir state, with an area of 2630 km^2 partly comes under Pir Panjal mountain range. It lies between 70 – 74°4' East longitude and 32°58' – 33°35' North latitude. A wide diversity of vegetation from subtropical to alpine type exists in the region. Although some studies have been undertaken to document the information on higher plants of the district (Rashid, *et al*, 2008; Pant and Verma, 2009; Sarver, *et al*, 2009; Pant, 2011), lower groups of organisms, despite their pivotal role in stabilizing the ecosystems, have got least attention till date. As such no information is available on their number, diversity in the habit, habitat and their potential as useful organisms. The present study aims to fill the gap by collecting information on one such significant group i.e. lichens. Lichens are the most successful symbiotic organisms in nature, dominating 8% or more of the earth's terrestrial area (Ahmadjian, 1995). These are among the most significant indicators of air pollution and ecosystem health (Upreti and Pandev, 1994; Wolseley, *et al*, 1994; Upreti, 1995; Sloof, 1995; Mistry, 1998; Vokou, *et al*, 1999). Economically lichens are very significant, being used in traditional medicines (Gonzalez – Tejero, *et al*, 1995; Upreti, 1994; Negi and Kareem, 1996), as dyes (Casselman, 2001), as staple diet of the Alaskan reindeer (Skunke, 1969) and Himalayan musk deer (Negi, 1996). India is a rich centre of lichen diversity, contributing nearly 15% of the 13,500 species of lichens recorded in the world (Groombridge, 1992). Despite this, there is a poor record of lichen explorations and many areas, especially mountains and forest canopies remain unexplored

(Negi and Gadgil, 1996; Negi and Upreti, 2000). In India, Jammu and Kashmir is one of the lichen rich regions, oftenly known as 'Hot Spot' of lichen diversity (Sheikh, *et al* 2006). In Jammu and Kashmir too, no earlier data of lichen explorations is available for Rajouri, Poonch, Kathua and Kupwara (Sheikh, *et al*, 2006). There is need to generate baseline data and gather information on them in this part of country.

After independence the region has undergone lot of changes due to urbanization, infrastructural development, construction of roads in far flung areas and improvement in the transport facility there by increasing the traffic density even in the distant townships. Consequently, one of the serious environmental threat in this region, as in rest of the world, is the increasing concentration of pollutants in the air and there is a need of better indicator systems to monitor air pollution. Lichens are being increasingly used as air quality biomonitors (Bartoli, *et al*, 1997; Malysheva, 1998; Ockenden, *et al*, 1998). They have several advantages over electronic monitors which are expensive and their use and maintenance are not simple. In addition electronic monitors are limited to few elements or chemical compounds and have no intrinsic relationship with the biological effects of contaminants (Rodrigo, *et al*, 1999). In India, however, only a few reports regarding use of lichens in air pollution monitoring are available (Das, 1985; Dubey, 1999).The study planned will include the effect of various pollutants on lichens in the Rajouri district and physiological responses of lichens to pollution.

Objectives of the study:

Following are the objectives of the present study to be undertaken in Rajouri:

1. Collection and identification of the lichens from diverse habitats of the district.

2. Ecological assessment of lichen diversity.
3. Comparison of lichen types with respect to air pollution levels.
4. Determination of the tolerant and sensitive lichen species.
5. Metal estimation including heavy metals in different lichen species collected from the natural habitats and after transplantation.
6. Ethno botanical uses of the lichens will also be documented.

Methodology

1. **Taxonomic studies**: Extensive surveys and collection trips shall be carried out for exploration of lichens of the region. Taxonomic details of the lichens will be worked out following the methodology proposed by Awasthi (1988, 1991, 2000) and the lichen chemicals will be identified following Walker and James (1980).
2. **Ecological studies**:

a. Ecological parameters such as number, density, frequency and abundance of the lichens in the field will be studied. These parameters will be used to calculate the Shanon Wiener's diversity index (Shanon and Wiener, 1963). For this purpose, quadrats of 1sq. m will be laid and lichens as well as the substrate on which they grow will be carefully recorded. Data generated will be analysed statistically. Data thus collected will provide an account of the distribution pattern of lichens which will be helpful in preparing the lichen map of the region.

b. In case of corticolous lichens, bark pH will also be measured using a pH meter after soaking bark extract in distilled water for 1 hour at 80 °C. Thus pH of the host tree suitable for lichen growth will be determined.

3. **Grid plotting**: For determining the impact of air pollution on lichens grid plotting will be done. Each site will be divided into plots of 1 sq. km and

the number of species as well as their distance from source of pollution will be recorded (Saxena, *et al*, 2007).

4. **Metal estimation**: For metal estimation of lichen species, the collected species, removed from the substratum, will be oven dried at 90°C and subjected to acid digestion in the mixture of HNO_3 and $HClO_4$ (v/v 9:1) until appearance of colourless solution followed by its filtering using Whatman's filter paper No. 42 and dilution to 25ml with distilled water. Metal content will be analyzed using Atomic Absorption Spectrophotometer following Saxena, *et al*, 2007.
5. **Lichen Transplant:** Sampling and measuring contaminants within the thallus is one of the ways to use lichens as air pollution monitor. For monitoring metal levels in areas devoid of lichen growth, transplant technique will be used. Different sites will be selected for transplanting lichens in the Rajouri district. *Hyperphyscia adglutinata* (Floerke) Mayrh and Poelt a common foliose lichen, collected from areas far away from any local source of atmospheric pollution will be used for the study. Thalli of similar sizes along with the substrate will be glued to a cardboard of 20×20 cm size and then transplanted at a pole at the selected site for exposure. The duration of exposure will be 18 days (Bajpai, *et al*, 2004) to 16 weeks (Bačkor, *et al*, 2003) for each transplant. Afterwards, the samples will be collected from the monitoring sites and lichens will be removed from the bark for heavy metal estimation.
6. **Ethnobotanical studies:** Semi – structured, open ended questionnaire will be prepared for generating ethnobotanical information.

Possible outcomes:

The possible outcomes of this work will be:

a) a baseline data on taxonomy of lichens of the region will be created.
b) an account of the lichen diversity of the study area will be documented.

c) records on the status of air pollution in Rajouri district will be compiled.
d) best pollution indicator species will be identified and the species accumulating highest concentration of heavy metals will be determined. They will then be recommended for determining air pollution concentration at other places.
e) a lichen garden/sanctuary will be established in the Pir Panjal Biodiversity Park, BGSBU for their conservation.

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